

# Assign Measures Tool

## Application Documentation

April 7, 2008

### Introduction

The purpose of the Assign Measures Tool is to look up and assign measures to Caltrans Postmiles.

A Geographic Information System (GIS) process called **Dynamic Segmentation** can be used to create points or linear segments coincident with linework based on a unique route identifier and a distance from the beginning of the route (called a "measure"). Points require a single measure, lines require begin and end measures. This allows the creation of spatial (GIS) data from tabular data that contain route and measure information.

Caltrans relies heavily on this route and measure system to identify locations along state highways. Routes are uniquely identified within each county, and postmiles are the measures. For more detailed information about the Caltrans Postmiling system refer to the companion document **CaltransPostmileSystem**.

Unfortunately, over time postmiles have been rendered invalid as measures as highways have been shortened or lengthened due to changes in alignment. Rather than re-postmile the route from realignment and beyond, just the affected portion is repostmiled, and given a character prefix (most commonly "R") that differentiates it from the original postmile. As a result, postmiles are no longer a sequential number, and there can be gaps and overlaps in postmiles. The companion tool **SequenceLookup.exe** lists all valid highway segments in their sequential order.

Dynamic segmentation is still possible, but it requires a separate, true measure system and functionality to convert postmiles to true measures. That is the purpose of the Assign Measures Tool.

### Overview of the Tool

The Assign Measures Tool includes an Access database that contains a GIS layer of all state highways and various lookup tables. The state highway layer (called **LRSAlb83**) is actually a Linear Referencing System (LRS), where each feature is a unique route that is measured (and calibrated) from beginning to end.

The tool reads input data (user-supplied) from a separate Access database, uses data in the lookup tables to determine the corresponding route and measure for each county, route, and postmile, then copies the input data to an output table along with the route and measure information.

The output table can be used in ArcMap to dynamically segment LRSAlb83 (the state highway LRS layer) to create a **Route Event Table**. After reviewing any errors from the Assign Measures Tool and the dynamic segmentation process, the route event table can optionally be exported to various GIS formats (typically shapefile or feature class).

## Installing

There is not a standard installation process for the tool. Simply copy **AssignMeasures.exe** and **LRS.mdb** to any local hard drive or network location. Multiple users can access a single copy of the tool if it is on a network location. It is not necessary for the executable and the database to be in the same directory (the user is asked for the location of the database when running the tool, and the tool remembers this location for subsequent use).

## Input Data

Input data must be in an **Access database** in any of the following formats:

### Points

County	Route	PM
Mon	101	R19.2
Son	101u	50.2
Fre	168S	R0
LA	5s	C44.5R
LA	5S	C43.899L
Mon	101	R40.5
Mon	101	R41.048L
Mon	101	R41.048R
Mon	101	R42.1L
Mon	101	R42.1R
Mon	101	43.3

### Lines

Cty	Rte	BeginPM	EndPM	Side
Mon	101	R19.2	R21.9	Right
Son	101u	50.15	53.4	Both
Fre	168S	R0	R2	left
LA	5s	C44R	C44.924R	Right
LA	5S	C43.899L	C44.9L	
Mon	101	R40.5	R42L	Left
Mon	101	R40.5	R42R	R
Mon	101	R41.048L	R42.401L	L
Mon	101	R41.048R	R42.394R	r
Mon	101	R42.1L	43.2	l
Mon	101	R42.1R	43.2	right
Mon	101	43.3	44	
Slo	1	0	6.5	

### Or

Co	Route	BeginEndPM
Mon	101	R19.2 /R21.9
Son	101u	50.15 / 53.4
Fre	168S	R0/ R2
LA	5s	C44R/C44.924R
LA	5S	C43.899L/C44.9L
Mon	101	R40.5/R42L
Mon	101	R40.5/R42R
Mon	101	R41.048L/R42.401L
Mon	101	R41.048R/R42.394R
Mon	101	R42.1L/43.2
Mon	101	R42.1R/43.2
Mon	101	43.3/44
Slo	1	0/6.5

### ***Requirements and Recommendations***

- ***Access***
  - The data must be stored in an Access table or query.
  - If Access is not available, ***ArcCatalog*** can be used to create a Personal Geodatabase, and a table in the Personal Geodatabase. The table can be populated in ***ArcMap***.
- ***Field Names***
  - There are no specific requirements for field names, though if exporting to shapefile there is a 10 character limit with no spaces.
- ***County***
  - County must be the proper two or three character abbreviation (see table at the end of this document).
  - Upper and lower case are acceptable.
- ***Route***
  - A few routes have a suffix. This suffix must be part of the route field.
- ***Begin / End Postmiles***
  - Begin and end postmiles for line features can be stored in one or two fields (see examples above).
  - If stored in a single table they must be separated by a forward slash ("/"). Spaces are ignored.
  - Note that there can be a postmile prefix that is described briefly in the ***Introduction*** section, and in greater detail in the companion document ***CaltransPostmileSystem***.
  - Note that there can also be a postmile suffix that indicates the side, or direction where there are ***Split***, or ***Independent Alignments***. This is described in the companion document ***CaltransPostmileSystem***.
- ***Side, or Alignment (optional)***
  - A field indicating the preferred side can be used, or the tool will offer an alignment choice for all features.
  - Values must start with
    - "R" (right - east or northbound), or
    - "L" (left - west or southbound), or
    - "B" (both).
  - Upper and lower case are acceptable.
  - Blank values will be placed on the right.
- ***Use of Access Queries***
  - The tool will read an Access query as well as an Access table.
  - If your data are already stored in Access, but not in the proper format, consider an Access query that properly formats the data.
  - For example if the postmile prefix, postmile, and postmile suffix are stored in separate fields, a query can be used to aggregate them into a single field.

### **Running the Tool**

To run the tool, double-click AssignMeasures.exe. A form will open that is ready to accept the following inputs:

#### ***Source Data***

The Access database containing your input data. Click the "envelope" icon to browse for the database. This database will be remembered for subsequent sessions of the tool.

**LRS Data**

The Access database containing all the reference data, including the LRS layer. This database is provided with the tool. The name and location of the database will be remembered for subsequent sessions.

**Input Table**

This is a pulldown list of all the tables and queries found in the input database. Select the one that contains your input data.

**Route Field**

This is a list of all fields found in the *Input Table*. Select the field that contains the route.

**Begin County Field**

This is a list of all fields found in the *Input Table*. Select the field that contains the county (for points), or county of the begin postmile (for lines). Most commonly the begin and end counties will be the same, but they can be different for those events that cross county boundaries.

**End County Field**

This is a list of all fields found in the *Input Table*. Select the field that contains the county of the end postmile (for lines). This will be disabled if *Point Geometry* is selected.

**Begin PM Field**

This is a list of all fields found in the *Input Table*. Select the field that contains the postmile (for points), or begin postmile (for lines).

**End PM Field**

This is a list of all fields found in the *Input Table*. Select the field that contains the end postmile (for lines). This will be disabled if *Point Geometry* is selected.

**Output Table**

This is a list of all the tables found in the input database. You can select one to overwrite, or enter a new name to create a new table.

**Route Alignment**

Determines if **Route Events** ("events") will be placed on the left, right, or both alignments. Location of the events will be different for those routes where there is a median separating both directions of travel.

- Left – Events will be placed on the west or southbound directions.
- Right – Events will be placed on the east or northbound directions.
- Both – Events will be placed on both directions. This will result in duplicate features, except where there are independent alignments.
- Field – Placement will be determined by the value found in a field. Selecting this option enables the pulldown list of fields. This allows greater flexibility for the placement of individual events. Field values can include:
  - Anything starting with "L" or "l" – will be placed on the left side
  - Anything starting with "R" or "r" – will be placed on the right side
  - Anything starting with "B" or "b" – will be placed on both sides
  - Blank values will be placed on the right side

### ***Geometry***

Determines if points or lines are to be created. If input data are mixed (both point and line), then they must be separated into two tables and processed individually.

### **Output Data**

Upon completion of the tool the output table will contain all records and fields from the input table, plus four (for points) or five (for lines) fields containing dynamic segmentation data and status. There will also be additional records for any records where both alignments were chosen (unless the postmile reference fell on an *independent alignment* where the postmile suffix references just one side). Fields added by the tool include:

#### ***ROUTE\_GEOM\_ID***

This is the unique route identifier.

#### ***Measure*** (points only)

This is the measure corresponding to the input postmile.

#### ***Bmeasure*** (lines only)

This is the begin measure corresponding to the input begin postmile.

#### ***EMeasure*** (lines only)

This is the end measure corresponding to the input end postmile.

#### ***MeasStatus***

This is a short message indicated the success of the tool:

- No Error – Route ID and Measure(s) successfully assigned.
- Warning – Value beginning with “Warning –” indicates that a Route ID and Measure(s) were assigned, however a change was made (generally when a postmile suffix was encountered that conflicted with the alignment directive – postmile suffix takes precedence).
- Error – Value beginning with “Error –” indicates that a Route ID and/or Measure(s) were not successfully assigned. These records must be corrected and rerun for the ***Create Geometry*** process to succeed.
- Most errors result from missing postmile prefixes or alignments, or improper rounding of postmiles. The companion tool ***SequenceListing.exe*** can help resolve errors by listing all valid highway segments, with prefixes and alignments.

#### ***EvtID***

This is a unique identifier that allows improved functionality (the ability to select records) in the subsequent ***Create Geometry*** process.

## Creating Geometry

Once Route ID and measure(s) have been successfully assigned, ArcMap can be used to create a Route Event Table, then export that to Shapefile for Feature Class. This requires the use of the Linear Reference System that is part of the **LRSalb83** layer included in the **LRS.mdb** Personal Geodatabase.

### ArcMap

- Start up ArcMap and add the Feature Class **LRSalb83** from the **LRS.mdb** Personal Geodatabase.
- You may want to save this ArcMap document for future use.

### Create Route Event Table

There are various options for creating a Route Event Table, just one approach is shown here:

- From the **Tools** menu, **Add Route Events**.
  - Route Reference: **LRSalb83**
  - Route Identifier: **ROUTE\_GEOM\_ID**
  - Event Table: Browse to your Access database and select the output table created with the Assign Measures tool
  - Route Identifier: **ROUTE\_GEOM\_ID**
  - If Points:
    - Choose **Point Events**
    - Measure: **Measure**
  - If Lines:
    - Choose **Line Event**
    - From-Measure: **Bmeasure**
    - To-Measure: **EMeasure**
  - Advanced Options...
    - Check **Generate a field for locating errors**
- Check for errors:
  - Right-click on the newly created Route Event Table, **Open Attribute Table**
  - Review the field **LOC\_ERROR**
    - Values other than "NO ERROR" were not successfully placed, and the reason is given

### Export

At this point the Route Event Table can be used as is, or it can be exported to shapefile or a geodatabase Feature Class:

- If there were errors you can either resolve them, or you may wish to select records without errors and export just those.
- Right-click on the Route Event Table, **Data, Export**.
- Export: **All features**, or **Selected features** if a selection was performed.
- The layer's coordinate system is the California Albers, NAD83. If a different coordinate system is desired, you can back up and change the data frame's coordinate system before exporting, then choose Use the same coordinate system as the data frame.
- Select the output shapefile or feature class
- **OK**

### Support and Updates

Questions or problems regarding the tool or reference data can be directed to:  
Andy.Richardson@dot.ca.gov

The date of the tool is at the lower right corner of the frame in yyyyymmdd format.  
Tool functionality may change over time, and the reference data will change as well.  
You might consider contacting Andy Richardson to see if updates are available.

### County Names and Codes

CODE	NAME
ALA	Alameda
ALP	Alpine
AMA	Amador
BUT	Butte
CAL	Calaveras
CC	Contra Costa
COL	Colusa
DN	Del Norte
ED	El Dorado
FRE	Fresno
GLE	Glenn
HUM	Humboldt
IMP	Imperial
INY	Inyo
KER	Kern
KIN	Kings
LA	Los Angeles
LAK	Lake
LAS	Lassen
MAD	Madera

CODE	NAME
MEN	Mendocino
MER	Merced
MNO	Mono
MOD	Modoc
MON	Monterey
MPA	Mariposa
MRN	Marin
NAP	Napa
NEV	Nevada
ORA	Orange
PLA	Placer
PLU	Plumas
RIV	Riverside
SAC	Sacramento
SB	Santa Barbara
SBD	San Bernardino
SBT	San Benito
SCL	Santa Clara
SCR	Santa Cruz

CODE	NAME
SD	San Diego
SF	San Francisco
SHA	Shasta
SIE	Sierra
SIS	Siskiyou
SJ	San Joaquin
SLO	San Luis Obispo
SM	San Mateo
SOL	Solano
SON	Sonoma
STA	Stanislaus
SUT	Sutter
TEH	Tehama
TRI	Trinity
TUL	Tulare
TUO	Tuolumne
VEN	Ventura
YOL	Yolo
YUB	Yuba